THE MEDICAL USE OF ELECTRICITY

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The Gift of

Negative Pole - Strongest -
or Zinc pole or wire or
Cathode
Positive pole weakest - copper
wire of a battery or the anode

Page 704 & 705

From med & Surgical Electricity
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large book

SHORTLY TO BE PUBLISHED.

CHRONIC DISEASES OF THE LARYNX,

With Special Reference to Laryngoscopic Diagnosis and Local Therapeutics.

BY

DR. ADELBERT TOBOLD,

LECTURER IN THE UNIVERSITY OF BERLIN.

Translated from the German and edited by

GEORGE M. BEARD, M.D.

With an Introduction on the History and Art of Laryngoscopy and Rhinoscopy, Rhinitis, Inhalations and Electrization applied to diseases of the Air Passages,

BY THE EDITOR.

ILLUSTRATED WITH WOODCUTS.

It is believed that this treatise of Dr. Tobold embraces in a compact form more that is at once instructive and practical on the chronic diseases of the Larynx than any other work that has appeared since the invention of the Laryngoscope. In thus adapting it for the Profession, it has been the aim of the Editor to supply a want that has long been felt of a single work which should be a guide in the study of all the Chronic Diseases of the Throat and of the ordinary inflammations of the Nasal Passages, as well as in the methods of diagnosticating these affections with the aid of the Laryngoscope and Rhinoscope.

WM. WOOD & CO., Publishers,
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THE

Medical Use of Electricity,

WITH SPECIAL REFERENCE TO

GENERAL ELECTRIZATION

AS A TONIC IN

NEURALGIA, RHEUMATISM, DYSPEPSIA, CHOREA, PARALYSIS,
AND OTHER AFFECTIONS ASSOCIATED WITH
GENERAL DEBILITY.

With Illustrative Cases.

BY

GEO. M. BEARD, M.D., AND A. D. ROCKWELL, M.D.

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PREFACE.

In the summer of 1857, one of the authors of this treatise, while pursuing his studies, began to experiment with the induced current of electricity in the treatment of indigestion, nervousness, and general debility. The method employed was substantially modeled after the "localized electrization" of Duchenne; but the results, though in some instances very decided, were, on the whole, unsatisfactory.

But the soothing and invigorating effects of a persevering use of a steady current of induced electricity were so manifest in his own person, and in other cases where it was employed, that he was encouraged to continue his investigations at various intervals, both in hospital and in private practice. The results, however, were still unequal and inconstant, owing partly to the want of a convenient, reliable apparatus, but chiefly to the fact that the applications were too exclusively localized over certain muscles, nerves, or organs.

In the summer of 1866, we began to study together the subject of the medical use of electricity by treating different forms of paralysis and rheumatism.

But instead of localized, we now used general, electrization, according to the method herein described. The results were far beyond our anticipations. We found that many of the patients thus treated were not only relieved of their local symptoms, but were also improved very markedly in their general condition. We found that old cases of indigestion, with the usual accompanying symptoms, and a variety of disorders associated with general debility, were very appreciably relieved, and in some instances entirely or approximately cured by persistent treatment.

What is here written is simply the story of our experience with *general electrization*, and is manifestly very different in scope and arrangement from what it would have been if it had been intended to prepare a guide to electro-therapeutics. The articles were originally published in the "*Medical Record*," and the unexpected attention they received from the profession, and from other journals at home and abroad, suggested the idea of presenting them in this form.

If this treatise shall have the effect of inducing any one in the profession to enter on the scientific study of general electrization with anything of the zeal that localized electrization is now pursued abroad, its purpose will have been fully secured.

A. D. Rockwell, M. D.,
Geo. M. Beard, M. D.

New York, 914 Broadway.

EXPLANATION OF TERMS.

As we are from time to time receiving letters of inquiry from physicians in regard to the nomenclature of electro-therapeutics, we have thought it would be well to give a brief explanation of some of the terms and phrases that are apt to present the greatest difficulty to those who are beginning to investigate the subject.

It should be remarked, however, that among medical writers in general much confusion still continues to exist in the use of these terms. "Battery" and "electro-magnetic machine," "Galvanism" and "Faradaization," "primary" and "secondary," are often confounded even by those who in nearly every other department of medical science are well informed.

GALVANIC BATTERY—ELECTRO-MAGNETIC MACHINE.

A *galvanic battery* is usually formed of three substances, two of which are metal, and the other some dilute acid that generates electricity by its action on one of the metals. It is also called an "element" or "cell."

The *compound galvanic battery* consists of a number of simple batteries connected in a series. Thus we have the voltaic pile, and Grove's, Bunsen's, or Smee's compound battery, composed of more or less simple batteries of their respective varieties.

Negative Pole is the Zinc wire
and gives the strongest shock
Positive Pole the weakest — copper wire

Farmer's thermo-electric battery, composed of bars of German silver, and an alloy of zinc and antimony, arranged in a V shape, so as to be heated (by gas or an alcohol lamp) at their point of union, has recently come into use.

An *electro-magnetic machine* is composed of a helix and vibrating armature, connected with some form of battery. It may be used with Bunsen's, Smee's, or Grove's battery, or with any modification of them, or with Farmer's thermo-electric battery.

In *magneto-electric machines* a soft iron armature is made to pass rapidly the poles of a magnet by turning a crank. They are very inconvenient, and must soon give way to *electro-magnetic machines.*

QUANTITY—INTENSITY, OR TENSION.

The *quantity* of electricity generated by any apparatus is proportioned to the amount of chemical action that takes place in the battery. Intensity is that power that enables it to overcome resistances that may impede the progress of the current.

The electricity of an ordinary thunder-storm is great in intensity, but exceedingly small in quantity. On the other hand, that which is generated by any ordinary form of battery has comparatively a great deal of quantity but little intensity. The *quantity* supplied by any battery may be increased by increasing the chemical action that takes place in it, either by making it larger, or by strengthening the acid solution.

In a *compound battery* the *intensity* is increased in proportion to the number of batteries, but the quantity is no greater than in the single battery of which it is composed.

The relative meaning of these terms may be best un-

derstood by an illustration. A gallon of water heated to 100° has a much greater quantity of heat than a pint heated to 500°; but the heat of the latter is much more intense.

GALVANIZATION—FARADAIZATION.*

The current that proceeds from any simple or compound battery is called the "primary current," sometimes also the "continuous," "constant," or "uninterrupted" stream. Its use in medicine is called *galvanization*, from Galvani.

When the current from any simple or compound battery passes through a helix, and induces another current that is interrupted by a vibrating armature, such a current is called the "induced," "secondary," "interrupted," or "faradaic," from Faraday, and the entire apparatus is called an electro-magnetic machine; its use in medicine is called faradaization. This is the current that we usually employ in *general electrization.* In Germany, the current from a voltaic pile is called "continuous," that from all other batteries "constant;" with us this distinction is not ordinarily observed.

ASCENDING—DESCENDING.

The course of an electric current is always from the positive to the negative pole. When, therefore, the current runs from the periphery toward the centre, against the course of the nerves, or of any single nerve, it is called ascending, or "reverse;" when it runs from the centre toward the periphery, with the

* We have adopted the orthography *faradaization* in preference to *faradisation*, introduced by Duchenne, for the reason that, while both are equally legitimate, the former has the additional advantage of more directly suggesting the name *Faraday*, from whom it was derived.

course of the nerves, or of any single nerve, it is called the descending or "direct" current.

The ascending current in its immediate effects is painful and irritating; the descending is calmative and exhilarating.

In general electrization we use mainly the descending current; in localized electrization either the ascending or descending may be used, according as exciting or soothing effects are indicated.

GENERAL ELECTRIZATION—LOCALIZED ELECTRIZATION.

In *general electrization one of the electrodes is placed at the feet, while the other is applied over the entire surface of the body, and the whole system is affected by the current.*

In *localized electrization* the electrodes are applied near to each other, and the effects of the current are supposed to be mainly confined to the tissues lying between them.

THE

MEDICAL USE OF ELECTRICITY.

EARLY INVESTIGATIONS.

The history of the medical employment of electricity has been marked by many and peculiar disappointments.

It was very natural to infer that an agent at once so mighty and mysterious in its phenomena, should have a great power for good or evil over the human constitution. Hence we find, that after the researches of Galvani had abundantly established the doctrine of the existence of animal electricity, very many enthusiastic observers set themselves to the task of demonstrating the medicinal virtues of this subtle fluid. Their experiments were attended with a measure of success. Aldini, in 1795; Hufeland, in 1798; Alibert, in 1817; and Dr. Mansford, in 1818, clearly established the fact of the remedial powers of static electricity in certain forms of paralysis and epilepsy. The discovery of the induction current by the great Faraday, in 1831, gave a new

impetus to the scientific investigations in this department. Matteucci, Du Bois Reymond, Golding Bird, Duchenne, Remak, and more recently, Brown-Séquard, Rosenthal, Meyer, Benedict, and Ziemssen, have all labored diligently in the field of physiological and medical electricity, and have brought many and valuable sheaves with them.

APATHY OF THE PROFESSION WITH REGARD TO THE SUBJECT.

By these investigators, the remedial as well as the physiological effects of electrization have been repeatedly demonstrated. They have proved that, not only in paralysis and epilepsy, but also in cases of debility and impaired nerve energy, electricity is an agent of vast and wondrous powers. And yet, outside of the ranks of these original explorers, there are comparatively few in the profession who have given the subject sufficient heed even to inform themselves as to the diseases for which galvanization or faradaization is specially applicable. This apathy of the medical world with regard to the success of experiments that promise so much and so surely for the department of therapeutics, is to be accounted for by a variety of reasons. First of all, electricity, in the various methods in which it is employed, has not fulfilled the general expectation. It has been found to fail utterly in many cases where theoretically it should have achieved the most absolute success; and hence many, disappointed and perhaps

disheartened, have illogically concluded that their expectations were not well grounded.

EXPERIENCE OF CHARLATANS.

Again, in our country at least, the practical application of this agent has fallen into the hands of uneducated and unscrupulous practitioners, who know little of the human system, or of the science of medicine, and still less of the agent they employ. Empirics and charlatans, versed in no art except that of robbing the unfortunate, have thus far had the field mostly to themselves, and have improved their advantage by filling their own pockets without adding an iota to the world's stock of experience. Whatever valuable truths they may have stumbled upon by their abundant observations are known only to themselves, and are regarded by them merely as tricks of a trade, and in the very nature of things must die with them. Electricity appears to be travelling slowly in the footsteps of all our permanent specialties. Twenty years ago, the treatment of the diseases of women was almost exclusively in the hands of ignorant and unprincipled outsiders; gynecology is now one of the most honored and useful departments of science. It is but fifteen years since oculists were linked with contempt in the speech of all who desired to be regarded as authority in medical etiquette; to call oneself a specialist for the eye was a plea of guilty to the grossest ignorance and fraud.

Ten years ago, the diseased throats and ears of the country were at the mercy of a crowd of the most rapacious sharpers that ever amassed fortunes out of human suffering and credulity; ten years hence, laryngoscopists and aurists will stand on the same platform with oculists and gynecologists.

It is the duty, and it should be the delight, of scientific men, to wrest the medical employment of electricity from the hands of these selfish harpies, and accord to it that honor to which its merits justly entitle it.

CAUSES OF THE ILL SUCCESS OF PHYSICIANS IN THEIR EXPERIMENTS WITH ELECTRICITY.

At the present time medical practitioners of all grades are not unwilling to recommend electricity in certain cases of paralysis, that will neither yield to internal medication nor get well in spite of it; but they usually allow their patients to use some kind of apparatus at home, or else content themselves with two or three imperfect applications under their own eyes. The results in such cases are almost always unsatisfactory. It could not, indeed, be otherwise. In this way, more than in any other, electricity has been wounded in the homes of its friends. To one case that is cured or relieved by such slipshod procedures, ten are either made worse, or else so little benefited that they cast their batteries aside, and ever afterwards declare that electricity is a humbug. The truth is, that there is no more sense or reason in allow-

ing patients to make their own applications of the electric current, than there would be in intrusting them with the responsibility of cutting their own veins, or of operating on their own ears and eyes. In three important particulars we are apt to mistake in the employment of electricity. 1. By neglecting to make just discrimination in regard to the types and phases of disease that are found to yield most readily and surely to this method of treatment. 2. By intrusting the details of the applications to the patients themselves, or some of their non-professional attendants. 3. By not making the applications with sufficient thoroughness and persistence.

OUR EXPERIENCE.

Our attention having been called to this subject for some time past, we have found that the range of diseases amenable to this form of treatment is much wider than we had ever supposed. We have found that faradaization, or the use of the secondary current, is especially indicated in cases of indigestion in all its myriad shapes; in nervous derangements, when they take the form of chorea, epilepsy, neuralgia, or hypochondriasis; and in general debility and anæmia, dependent on any cause except pulmonary tuberculosis.

METHODS OF APPLICATION—THE USE OF THE HAND AS AN ELECTRODE.

Three different methods of applying electricity have

been recommended by Duchenne; by solid metallic electrodes, metallic brushes, and the hand.

Of these methods we much prefer the latter.

No instrument that human skill shall devise can ever equal the hand in flexibility and power of adaptation. If the feet of the patient be placed on a sheet of copper to which the negative pole is attached, the operator, holding the positive pole in one hand, can with the other readily manipulate the parts desired to be affected, and by increasing or diminishing his grasp of the sponge, can modify the strength of the application without disturbing his apparatus.

EFFECTS OF THE CURRENT ON THE OPERATOR.

Used in this way, the current must pass through the body of the operator. The first essays of those who may employ electricity through their own persons, must always be unsatisfactory. They will find that they can bear only a very feeble current, or at least one not strong enough to affect any but the weakest patients, or the most sensitive localities. But practice is everything here, as in the use of all other appliances of medicine. According to our observation and experience, the system appears to become accustomed to the powerful electric stream, just as it becomes accustomed to the use of tobacco, alcohol, opium, hasheesh, or coca; with this difference, that its effects are, if anything, positively beneficial.

Dr. Garratt, of Boston (whose abundant opportunities for observation and varied practical experience in the medical employment of electricity, entitle his views to more consideration than those who have attempted to wade through the verbose and mystic rhetoric of his recent work will be willing to accord to him), advises "that the operator use the same hand that holds the electrode, so as to prevent the passage of so high an induction current through his own person, which is thus to himself highly injurious and unsafe to be long continued or often repeated."

It would be very natural to infer that an agent so potent in the cure of disease must be prejudicial to health when used in large excess, for such is found to be the case with nearly all the prominent articles of the materia medica.

It is on this probability that Dr. Garratt bases his words of warning; but the facts are against him. Obstinate experience will not wheel into line at the command of any scientific theory, however consistent or plausible.

We have now been employing faradaization through our own persons for some time, and the effects have thus far been either negative or beneficial.

We have both enjoyed our average health since we began to use the agent, and both have observed a marked development of the strength and size of the muscles of the arm. Wm. Miller,* of this city, a man

* It is but just to add that the suggestions and very large experience of this gentleman have been to us of invaluable service during all our investigations on the subject of general electrization.

of no special medical education, but of the utmost reliability, and thoroughly experienced in the practical application of the faradaic current, informs us that for the past thirty-five years he has allowed the stream to pass through his own body on an average about five hours each day. By mathematical computation, then, it appears that a powerful induced current of electricity has been passing through him for about seven years of his life. Up to the present time, his general health has been excellent, has indeed improved under the mighty stimulus, and he has suffered from no disease that can even be remotely ascribed to electricity. It is safe to say that no parallel instance can be found in either hemisphere.

THE LESSONS OF EXPERIENCE.

Our experience thus far seems to have taught us three important facts.

1. General electrization with the Faradaic current is a *tonic* of vast and varied powers, and it is chiefly through its tonic effects that it so rapidly and so surely benefits so many chronic asthenic diseases. It almost uniformly relieves chorea, dyspepsia, constipation, neuralgia, and chronic rheumatism; also, anæmia, when dependent on functional nervous derangement; and when faithfully and persistently employed, it not unfrequently works a permanent cure. Whether these tonic effects of faradaization

are the result of its mechanical action, or of some subtile nerve power that it mysteriously imparts to the system, or of both combined, we are of course unable to say. Nor is the question a vital one, however interesting it may be to the inquiring spirit of science.

The operators of the Atlantic cable inform us that sufficient electricity can be generated in a vessel no larger than a gun cap, to send a message from continent to continent, and they are ready to confess that they know as little of the nature of this agent as they did when Morse first planned the line to Washington.

Precisely the same principle holds good in the medical employment of electricity. Our ignorance of the rationale of its workings is no bar to our progress in the knowledge of its effects.

2. To gain satisfactory results from faradaization in long-standing cases of debility from whatever cause, the applications must be properly made and thoroughly persisted in. After the pendulum has been swinging for years in one direction, it does not make the return beat in an instant.

In employing electricity, just as in the use of medicaments generally, the time required to complete a cure must bear some proportion to the duration of the malady.

3. For the successful employment of electricity in the various diseases for which it is applicable, there is need of much more skill, patience, and experience, than is commonly supposed. It cannot be too often repeated,

line upon line, and precept upon precept, that no specialty in science, however restricted may be its scope, can be thoroughly mastered without a good measure of skill, energy, and patience. And in regard to this very humble department of electricity, in the selection and care of the apparatus, in the wise discrimination between the cases which are and those which are not amenable to this method of treatment, in the acquiring of the requisite facility and effectiveness of application—in the entire mastering of the whole subject, there is as wide a range for the exercise of scientific genius and diligence, and as imperious a necessity for large and varied experience, as in any other department of therapeutics.

DUCHENNE AND REMAK.

It was once remarked by a distinguished philosopher that "we may be sure that a science is in its infancy when its advocates are particularly dogmatic in the expression of their beliefs."

Judged by this standard, the science of the medical use of electricity is just emerging from infancy into childhood, for its disciples are far less positive in the declaration of their views in regard to the unsettled points connected with it, than were the original investigators fifteen years ago. A brief survey of the history of recent explorations in this department will fully explain our meaning. In 1850, Duchenne, of Boulogne, published

a work entitled, "Exposition d'une Nouvelle Methode de Galvanization, dite Galvanization Localisée," in which he announced the leading idea of his system, namely, that "one can localize the electric stream over a fixed point under the skin, if the end of a conductor be covered with a moist sponge, and strongly pressed upon the skin." In 1855, he published another work, an epitome of five years of experience, entitled, "De l'Electrization Localisée et de son Application à la Physiologie, à la Pathologie, et à la Therapeutique." This book excited not a little attention, and really created an era in medical science. It aroused the enthusiasm of the author's countrymen, who had the opportunity of witnessing his brilliant demonstrations, and was abridged for the German physicians, by Dr. Erdmann. But the number of those who were inspired to enter the list as investigators was comparatively small. Like all the original explorers in this department, Duchenne laid special stress on his physiological experiments. At no era of medical science had there been found any considerable number in any country who were willing and able to devote their lives to purely experimental researches that achieved no direct practical results. While Duchenne had astonished both himself and the scientific world by the novelty of his experience, neither he nor his admirers were fully alive to the immense therapeutical value of his discoveries. As a consequence, the cause of electro-therapeutics would not be espoused by those who felt compelled to turn all their endeavors to practi-

cal account, and but very few of those who warmed into enthusiasm over his demonstrations were willing to occupy themselves exclusively in the same field. But Meyer of Berlin, Baierlacher of Nürnberg, Althaus of London, made a specialty of this department, and have published works in which the method of Duchenne is adopted as the basis. Remak, of Berlin, was one of the few who were sufficiently alive to the value of Duchenne's experiments to pursue the subject still further, and in 1855 he embodied his experience in a work entitled "*Ueber Methodische Electrisirung Gelähmter Muskeln*,"—"On the Methodical Electrization of Paralysed Muscles"—in which he announced a system entirely different from that of Duchenne, and became the leader of an opposite school. The leading idea of his work was this: "That in order to bring a muscle to complete contraction, it is far better to excite its motor nerves than to allow the stream to operate upon the muscular substance itself."

Moreover, he employed the galvanic stream almost entirely, while Duchenne had performed his experiments with the faradaic current. Remak reported astounding cures, but at first failed in enlisting the sympathy of the profession. Subsequently, however, he learned wisdom by experience, and became more wary in his statements, and calmer in his manner of expression. Gradually the profession accorded to him their confidence, and some of the ablest minds of Germany—among whom we may name Benedict, Schulz, Meyer, Neumann, Rosenthal,

Frommhold, and Eulenberg—are numbered among his disciples. For some time a fierce and unreasonable controversy was carried on between Remak and Duchenne, which, both in its character and in its results, singularly reminds one of the fabled story of the knights who quarrelled over the pictures on the opposite side of the public sign. Remak contended for the application of the galvanic stream on the motor nerves, while Duchenne persisted that the best results were obtained with the faradaic, or induced current, on the muscles themselves.

At a public trial in Paris (as we are informed by Garratt), Remak demonstrated on a living subject that so far as producing contraction of a muscle goes, the induced current applied to the motor nerves is far less painful than when applied to the muscular substance. But so far as the general remedial effects of electricity are concerned, both were in the right, as is now tolerably well established.

GALVANIZATION AND FARADAIZATION.

So far as is yet ascertained, the remedial effects of electricity, whether employed in the form of galvanization or faradaization, are governed by no fixed laws. Experience is our only guide in their use. All the investigations of scientific men have thus far failed in reducing to any system the different therapeutical effects of the galvanic and the faradaic or induced currents.

Although there has been not a little speculation on this very theme, and although numberless experiments have been instituted with a view to establishing the superiority of the one or the other, yet we believe that the most progressive and candid of the investigators of the present day are willing to admit that the whole subject is yet in chaos. It has been found that the brilliant results that Remak obtained by the galvanic stream can also be secured by the use of the secondary current, and it has also been found that they are, so far as we can judge, very capricious in their effects, setting at defiance all the attempts of inquiring minds to reduce their employment to a logical system.

Those who are accustomed to use both kinds of electricity, namely, the galvanic or constant streams from a large number of elements, and the primary and secondary induced current of the electro-magnetic machine, testify that while all are beneficial, *no one* has been found to be so superior to the other as to justify its exclusive use.

There are cases where at first the induced current acts more speedily than the galvanic stream, which cases, later on, seem to be more amenable to the latter. One day a patient may present himself with a rheumatic disorder that is at once relieved by faradaization, and the next day another patient with precisely the same disease, at precisely the same stage, is more speedily aided by galvanization.

More than that, there are cases which at the beginning

of the *séance* are benefited by galvanization, and before its close yield to faradaization. Nay, further, there are instances where one form of electricity seems to irritate for the time being, while the other at once calms and soothes. What, then, is the law of their operation? There is none, so far as can be determined in the present state of our pathological knowledge, and there is no guide to their use except experience. The German investigators have carefully studied the effects of the different forms of electricity in exciting muscular contractions, and Ziemssen has experimented largely on the dead subject, and has ascertained the particular border points that are most susceptible to the electrical influence.

It has been very clearly established that muscular contraction is produced more completely and with less pain when the electrodes are placed on the "border points" where the motor nerve enters the muscle, than when applied to the bellies of the muscles themselves.

With these views of Remak and Ziemssen our experience fully accords. We have found that in certain cases of atrophy and loss of power, where we fail in producing contractions by application directly over the muscles, we do succeed very unaccountably by pressing the fingers along and underneath the borders of the same muscles.

We have found that some inveterate cases of rheumatism that evinced no signs of yielding when the hand was applied in a general way, at once took a fa-

vorable turn when the fingers were pressed along and underneath the borders of the muscles concerned.

But important as is this fact, it is hardly worthy of the attention it has received at the hands of some of the German investigators.

Ziemssen and Rosenthal seem to act on the supposition that electricity is chiefly useful in cases of paralysis, whereas its proudest victories have been gained over long-standing dyspepsia, constipation, neuralgia, amenorrhœa, chorea, hysteria, and other disorders connected with enfeebled vital organs, and a deranged nervous system.

On the other hand, we have found that the different forms of paralysis that present themselves to us for treatment give far less speedy and satisfactory results to the electrical treatment than almost any other form of disease. And yet physicians and the laity are possessed with the idea that paralysis is, *par excellence*, the disease that justifies the use of the battery.

WHAT MAY BE REGARDED AS ESTABLISHED IN ELECTRO-THERAPEUTICS.

Our present knowledge of the therapeutical value of the different forms of electricity may be thus summed up:

1st. Galvanization and faradaization are both of such positive value in paralytic, rheumatic, and neuralgic affections, that we are hardly justified in employing one to

the exclusion of the other. It would seem that the best results are obtained when they are used with alternations and variations, according to the indication of their effects.

2d. Muscular contractions are excited with the least pain and most speedily when one of the electrodes (either a sponge, a metal, or the hand) is applied along the edge of the muscle, and especially at the border point where the motor nerve enters the muscular substance.

3d. The ascending faradaic current has a great power of exciting muscular contractions, and stimulating the nerves, and is especially indicated in local paralysis, anchylosis, and plastic effusions. Applied through the body with the positive pole at the feet, its effects are not unfrequently very disagreeable.

4th. The *descending faradaic current, thoroughly applied, with the negative pole at the feet, is a tonic and corrective of far greater efficacy than any internal remedy now known to science.* Judiciously given, it can never work harm, save in advanced stages of pulmonary tuberculosis, and in such cases we rarely employ it.

5th. The hand is by far the best electrode, and for the following reasons:

(*a*) It is more effective, from its wondrous power of adaptation. The fingers, better than a sponge or metallic electrode, can feel their way along the border of the muscles and press towards the deeper tissues.

(*b*) By no other instrument can the patient receive the same quantity of electricity with so little irritation,

particularly when applied on the head, or over any sensitive diseased organ.

6th. *Although paralysis in its different forms is usually more benefited by electricity than by any system of internal medication, it is yet among the least tractable of the various diseases that present themselves for this method of treatment.*

7th. *The diseases which are found to yield most readily and surely to general electrization are neuralgia, dyspepsia, rheumatism of the subacute and chronic varieties, chronic bronchitis, constipation, amenorrhœa, anœmia, hysteria, and general debility.*

8th. The electric streams are of great value as adjuvants in the diagnosis of disease, inasmuch as any deviation of any part from its normal sensitiveness to their influence is readily indicated. In this way we learn where the disease is located, although we may not be able to determine its precise nature.

In order to illustrate more clearly to the profession the method and result of our treatment by faradaization, we propose to give in detail some of the more interesting cases of the various forms of disease in which we have employed it. We can hardly expect that the bare statement of the curative powers of electricity will receive absolute credence without the presentation of some typical examples.

Even Remak himself (as stated above) at first experienced not a little difficulty in gaining the confidence of scientific men. So easy is it to represent on paper

what is very difficult to practically achieve, and so ready are specialists to dignify their own peculiar method of treatment to the exclusion of all others, that we cannot hope for the full appreciation of the wondrous powers of electricity, except by those in the profession who may be led to employ the descending faradaic current as faithfully and persistently as we have ourselves.

NEURALGIA.

This horrible affection, which so often disheartens both physician and patient, we have found to yield to the persistent application of electricity, as uniformly perhaps as any other disease, unless it may be nervous dyspepsia. Whether it exists either in the weakly or the strong it is always greatly alleviated and generally cured, sometimes by a few applications, in other cases by protracted treatment.

Indeed our unexpected success in certain cases did much to stimulate us to make special investigations on the whole subject of electricity.

Case First.—In the latter part of August, 1836, Mr. B——, a broker down town, came to our office complaining of a severe neuralgia of the back of the head and neck, that had rendered his life miserable for one year and a half. He had consulted many physicians and had taken much medicine, but had found little relief. He was a tall, well formed, muscular man, with a hard, full face, that suggested great native vigor of constitution.

With not very strong assurance of hope, either on our part or on his, the treatment by the descending faradaic current was recommended and commenced on the 5th of September. He was relieved on the first application, which was a very thorough one, and extended over all the vital organs. On the 8th of September he again came for treatment, and reported himself as much improved. On the 10th he reported himself as being entirely free from pain. Another application was then made, and he bade us good-by, preparatory to going into the country. We could hardly believe that the cure could be anything more than temporary, and were not surprised when he again presented himself on his return and informed us that his old enemy had made him another gentle visit.

We gave him another thorough application. A short time since he called at our office, and informed us that up to that time he had been perfectly well.

Case Second.—Miss H. The following case proves that the most distressing and persisting of all neuralgic troubles, tic douloureux, may be cured where medication has failed.

This patient presented herself for treatment in the early part of September, expressing herself, however, as having but little hope of experiencing more than a slight temporary relief.

Previously she had been treated by electricity with some short-lived benefit; sufficient, however, at that time to inspire her with hope. She was doomed to

disappointment, for in a very few weeks the paroxysms of intense pain, which before had made her life miserable, returned with greater severity than ever. As she told her story, the sudden, sharp, shooting pains in her face would every few minutes cause her to hold her speech in agony. To such an extent had this mysterious disease affected her that occasionally her tongue seemed almost paralysed, and at times her utterance was thick and broken. These frequent and terrible paroxysms had left imprinted on her pale face an expression of constant care and suffering. Her physician had tried almost everything in the materia medica supposed to be beneficial in such cases; and so without delay, doubting yet hoping, we commenced treatment by faradaization. The patient came every other day, and for the first two or three times only a comparatively mild current was given.

The strength was gradually increased, but no improvement was manifest. After the seventh or eighth application, however, a current, as strong as the operator and patient could well bear, was given for fifteen or twenty minutes, at each sitting, and in addition to the external application, the tongue was thoroughly electrified by means of a metallic spatula. From this time a rapid improvement was noticed.

The paroxysms occurred less frequently and with less severity. She discontinued treatment on the 20th of October, having had no return of pain for three weeks. Up to this date, January 2, she has had, so far as we can

learn, no return of her trouble. Whether in this particular case the cure is *absolutely* permanent it is of course impossible to say; but enough is known to convince the patient and those who knew her that the benefit derived was great and incalculable.

Tic Douloureux, as is well known by any who may have had much experience in the application of electricity for the disease, is the most difficult to cure or benefit of all neuralgic affections.

Of the neuralgias, the cervico-occipital, intercostal, lumbo-abdominal, and cephalalgia, are all in the vast majority of cases speedily benefited; and although some facial neuralgias, which have resisted all treatment by medication, still fail to be cured by electricity, yet it is our experience that the great majority even of such cases are permanently relieved by persistent treatment, unless they depend on some incurable organic disease.

Case Third.—The power of electricity over neuralgia of a specific character was very well illustrated in the case of a Mrs. B., sent to us by Dr. Cummings.

When she first consulted us she represented that for years she had been suffering from a terrible neuralgia in the head, but which at times attacked other parts of the body. For six weeks the pain had been so severe that she had been unable to pursue her usual avocation, which was that of an operator on a sewing-machine. She was a plump, fleshy individual, with full round

cheeks, indicative of anything but delicate health. Indeed so vigorous did she seem that we told her that only local applications would be necessary in her case, and accordingly directed her to place her hands on the sheet of copper to which the negative pole was attached, while a very gentle current was passed over the front and back part of the head. The application had not been continued more than two or three minutes, when she exclaimed, "Doctor! my pain is all gone; this is the first quiet moment I have had for a long time."

The sitting lasted about ten minutes, and at its close she was directed to come again on the following day. The next morning she informed us that she had experienced no more pain in her head, but that "the disease had gone to her breast and shoulders." This fact, taken in connexion with some other statements that she had incidentally made the day before, led us to suspect that syphilis was the cause of her sufferings. In reply to questions, she confessed to every symptom of secondary syphilis, and in fact had been aware all along that the disease was in her system. According to our habit in such cases, we made the applications down the spine and over the vital organs. The relief was complete, although not as instantaneous as the day previous. Several times the applications were renewed at intervals of two or three days, and each time she expressed herself as very enthusiastic over the improvement she was making. We examined her throat with the laryngo-

scope, and found a slight degree of inflammation, which readily yielded to the nitrate of silver. The fifth time she came she reported that she had returned to her work, and was able to labor nearly as hard as at any time in her life. The horrible nocturnal pains had entirely disappeared, and her sleep, which before had been so much interrupted, was quiet and refreshing. There remained, however, some neuralgic distress in the eyes, which disappeared after a few more local applications.

In the case of a woman afflicted with syphilitic rheumatism and neuralgic pains of the left shoulder, we were able at first to give only a very temporary relief. The first six applications enabled her to raise her hand to the top and back of the head, which she had not been able to do for a number of months; but she soon relapsed, and was as bad as ever. She seemed inclined to persevere, and we continued to give her applications of the faradaic current, descending and ascending, alternately, over the affected shoulder.

Occasionally, also, we operated over the vital organs. After a protracted treatment of over two months, we succeeded in greatly relieving her neuralgic symptoms. She did not recover the full use of her arm, although she could easily raise it to the top and back of the head. Her appetite, which had been poor, decidedly improved.

Case Fifth.—Mrs. R., of Rochester, a married lady,

æt 38, came to us in August, 1866, complaining of severe and protracted paroxysms of pain in the fourth toe of both feet, that had distressed her for eleven years. Her story was a singular one, but in its essential particulars was typical of some of the cases that we are called upon to treat. She represented that for a long time hardly any week had passed in which she had not suffered pain, that often extended up the leg to the hip; and that her mental emotions—anxiety, terror, depression—at once telegraphed themselves to the diseased nerves and excited pain. Her general health was only fair, and her temperament was decidedly nervous. Sitting too long in over-heated rooms or in crowded assemblies—fatigue, produced by any cause, even the annoyance of listening to a dull sermon, or the sight of a strange clergyman in the pulpit, would make themselves felt in the offending members, and give rise to intense agony. There were no evidences of inflammation of the tissues of either toe, other than soreness of the first joint. Eight general applications of the descending faradaic current were given, but the patient apparently received no benefit.

Her pains still continued at intervals; nor was her general condition improved as much as usual in such cases. Moreover, slight œdematous symptoms appeared. She left us, and as we supposed, entirely discouraged.

Four weeks ago, she came into our office, looking fresh and healthful. She said that for three months after leaving us she had experienced no pain; that her

general health also steadily improved; but that a slight attack, a few days previous, brought on by a cold, had warned her of the liability of a recurrence of her old paroxysms, and for that reason she desired an application.

There can be little doubt that she is destined to suffer other attacks at times; for if the theory that such painful symptoms are caused by inflammations within the sheath of the nerve be true, then a paroxysm may be brought on at any time by long-continued exposure to cold.

ANÆMIA, DYSPEPSIA, AND GENERAL DEBILITY.

Our attention was first called to the utility of electricity in dyspepsia, by patients who were treated for other diseases, with which indigestion, in its various phases, was complicated.

Those upon whom general applications were made, reported an increase of appetite, relief of constipation, diminution in the frequency of attacks of sick headache.

Case First.—Mr. S., of Connecticut, came to us, complaining of headache, ringing in the head, vertigo, acidity of the stomach, distress after eating—in short, of all the usual symptoms of dyspepsia. His organization was distressingly nervous. All his movements were characterized by an unusual swiftness and haste. In his conversation, business and pleasure, the world and religion, were strangely mingled.

We half suspected incipient insanity. We told him that the treatment would be protracted, and advised him to receive an application once or twice a week, at least. For the first week or two there was no very marked improvement, although he said he always felt very much exhilarated after each application. After four or five sittings, the change for the better was very decided. Not only were his dyspeptic symptoms relieved, but his general nervousness was diminished.

His appetite was less capricious and exacting. Said he, "Before I tried electricity, I had to eat seven meals a day; now I can get along with only three." His brain seemed to progress with his stomach. His conversation was more subdued and logical. When we last saw him, he was a calmer as well as sturdier man.

In his case, there was no increase of muscular development, which is so often observed after repeated general applications.

Case Second.—Mr. T., a bookseller, aged 31, stated that for a number of years he had suffered from chronic dyspepsia, which had rendered his life miserable. He had lost much in flesh. Although 5 ft. 8 in. in height, his weight was but about one hundred pounds. He complained of regurgitations from the stomach of an intensely sour liquid, and on rising in the morning he was often troubled with pyrosis. Tympanitis was a frequent symptom, and oftentimes the accumulation of gas with-

in the stomach embarrassed the respiration, and disturbed the action of the heart. Treatment was commenced about the middle of October, 1866, and continued for four weeks, the faradaic current being applied three times each week. The daily regurgitations, the tympanitis, and pyrosis, gradually ceased to annoy him; and after the tenth application, he informed us that during the month he had increased in weight some fifteen pounds.

About the beginning of January, 1867, he called upon us, stating that his health was excellent, and that his total increase in weight, since he first commenced treatment by electricity, was some thirty pounds. He said that he did not feel that his digestive organs were as strong as they had been before he was attacked with dyspepsia, but they had ceased to give him any considerable annoyance.

Case Third.—Mrs. H., a widow lady, aged 32, came to us, Dec. 1st, complaining of a stiffness of the left knee, which had annoyed her for more than fifteen months, to such an extent that at times she was absolutely unable to walk. She was also troubled with an unpleasant cough, and some difficulty of the throat. Her bowels were much constipated, her digestion imperfect, and her circulation languid.

She was exceedingly nervous, and at times her sleep was much disturbed. From the fact that other joints were occasionally affected, we were inclined to the opi-

nion that rheumatism was the cause of the swelling and stiffness of the knee.

General tonic applications were recommended, down the spine, over the stomach, liver, and bowels, and especially over the affected joint. Immediate relief was experienced after the first *séance*. She was able to raise her left foot four inches from the floor, and the pain was greatly soothed. The next day she complained of some soreness, which is very often the case after the first general application. The same treatment was continued for one month, the patient visiting us three or four times a week. We examined her throat with the laryngoscope, and found a slight pharyngitis and laryngitis, that readily yielded to topical applications of nitrate of silver. The improvement was more rapid than we had anticipated. Her appetite became exceedingly keen, the bowels regular, her sleep refreshing, and the color returned to her cheeks. Moreover, the cough, which had caused her much unnecessary alarm, nearly disappeared. The patient was so pleased with the invigorating effects of the applications, that she persisted in the treatment for some time after the knee had ceased to trouble her. A short time ago she fell and injured her knee, causing it to exhibit inflammatory symptoms, that readily yielded to a repetition of the same treatment. Her general condition continued to be excellent. It is probable that she will have recurrences of the affection of the joint.

AMENORRHŒA.

Electricity has been used for both suppression and retention of the menses, by several continental physicians, and in some cases with excellent results.

Dr. Fordyce Barker has reported two or three cases of amenorrhœa successfully treated by electricity, in the New York *Medical Journal*.*

Case First.—In the early part of September, 1866, a young lady of eighteen came into our office and inquired what we could do to cure her disease of the heart. Her speech was only in broken utterances, and her breathing was short and rapid. She was decidedly anæmic, and had been troubled with amenorrhœa for two months. The patient was so hysterical that the first application was given with difficulty. Whenever the strength of the current was much increased, faintness was at once produced. After the first week, however, she could bear a current of ordinary strength without discomfort.

The treatment was continued for one month—the patient visiting us every other day. By that time her apparent cardiac symptoms had disappeared; her breathing was more natural; her cheeks full of color, and her step more firm. Her menses returned after the eighth application.

Case Second.—Miss D., aged 25, was sent to us by Dr. James L. Brown, to be treated for suppression of the menses, caused by a sea voyage five months previous.

* Vol. i. p. 138.

She was stout and vigorous, and complained of no other symptom. According to Dr. Brown's diagnosis, there was no organic uterine disease. We gave her a general application with the descending faradaic current. The next day she said that some blood had appeared. The application was repeated, a strong current passing over the bowels and lower portion of the spine. With that utter disregard for the interests of science that is not uncommon with that class of people, she visited us no more. Two weeks afterwards, one of us met her by chance, and ascertained that she had a healthful flow for two or three days after she left our office.

Case Third.—In the case of a Mrs. L., aged 37, also sent to us by Dr. Brown, we were not as successful; but the case is of interest, as exhibiting the tonic effects of general and persistent applications of the induced current.

For eighteen months she had not seen her courses, although she had been skilfully treated for a long time. Her general health was poor, and she was somewhat anæmic. Her appetite was feeble and capricious, and her rest was much disturbed. She was also annoyed with constipation, and with neuralgic pains in the hip. She was so near the change of life, and had given so little evidence of yielding to her previous treatment, that we gave her but slight encouragement. Six or seven applications with the descending faradaic current were given with good results, so far as her general

health was concerned; but her menses did not appear. We then applied the positive electrode against the os, and swept the negative over the lower part of the bowels and spine, and vice versâ, until we became convinced that it was useless to continue the treatment any longer. When she left us, her appetite was good, and her bowels regular; she could sleep soundly, and no longer experienced the neuralgic pains—but there were no indications of a return of her courses.

In cases of amenorrhœa associated with or dependent on anæmia, we do not expect to restore the lost function until after the general condition has first been improved.

CHOREA.

This strange and frequent malady we find to yield to repeated tonic applications, in nearly every case, although the treatment must often be quite protracted.

Mary S——, aged 14, first exhibited symptoms of chorea in the right side of the face, and in the right arm, April, 1866. She grew worse slowly, until November, when she came to us for treatment. General tonic applications were made about three times a week. Over the cerebellum, the head was far more than ordinarily sensitive to the current. After two weeks we could discern not the slightest improvement, and all parties concerned apprehended a failure. The treatment was continued a month longer, and with most pleasing results. She had good control over every

movement, and her general health was excellent. In all cases, we find that the spasms diminish in proportion to the bettering of the general condition.

The above, both in its results and in its difficulties, is typical of a number of cases that have come under our treatment. To what extent relapses will occur, if at all, time alone can determine.

RHEUMATISM AND PARALYSIS.

The profession are so familiar with the results of electrical treatment in cases of paralytic and rheumatic affections, that it seems almost superfluous to detail our experience with them. We employ the induced current successfully in all the stages of rheumatism. Where there is active inflammation, the cure is usually more sure and more speedy than in passive chronic states. *Under the careful use of the descending faradaic current, angry joints are soothed, burning pains subside, and the fiery skin is reduced in temperature.* Upon these facts of our experience, we lay special emphasis, because to use electricity in active inflammation is contrary to all the teachings of the past. We have met with the same gratifying results in our applications to recent sprains and acute conjunctivitis. It may here be remarked that we often fail in rheumatic cases, unless we employ general as well as local applications. The ordinary method of passing the current through the affected joints only, usually does some good, but rarely works a cure.

Case First.—C. W. R., aged 25, had been afflicted with subacute articular rheumatism for more than three years. At times he would seem to be almost entirely free from his trouble; but about twice a year, a severe attack would come on, lasting generally from two to three months. In the middle of July, 1866, after several months of comparative ease, the rheumatism again showed itself, and this time, with but little delay, he came to us for treatment.

On the 3d of August, when first seen, his right ankle was so swollen and painful that he could with difficulty ascend the stairs to our office. His left shoulder and hip, together with several of the joints of his toes and fingers, were also somewhat enlarged. Applications were given at first every other day, and then every third day for three weeks, at the end of which time the swelling in all the joints was dissipated, and the accompanying pain entirely relieved. According to his statement, the patient had never experienced a more severe attack, and its duration had invariably been from two to three months. In this instance he suffered but for one month from the beginning of the attack, treatment having been commenced after the lapse of about fifteen days. He promised to report, if he should have a return of his difficulty, but up to this time (February, 1867) we have heard nothing from him.

Case Second.—Miss L. was a sufferer from severe pains in the shoulder, wrists, and many of the joints of

the fingers. The right wrist was considerably swollen, together with the second joint of the thumb, third joint of the first finger, and the second joint of the second, third, and fourth fingers of the right hand. Of the left hand, the third joint of the first finger and the second joint of the third finger were enlarged. Some of the joints were of great size, and this state of things had persisted with little change, for over one year. Treatment was commenced, and continued for three weeks. On the arms, hands, and fingers, the ascending faradaic current was used exclusively. Thorough applications were made, however, over the digestive organs, particularly the stomach.

After the first application, the patient expressed herself as entirely relieved of the pain in the shoulder. The second sitting served to dissipate the swelling of the wrists, but as yet no decrease was observed in the size of the joints of the fingers. These, however, began to yield after the fourth application, and rapidly decreased in size until a cure was effected.

Time must decide how long cases like these will remain exempt from their rheumatic symptoms after they have been once dissipated by applications of electricity.

SYNOVITIS.

Mr. Geo. L., aged 35, stated that about the 1st of July, 1866, he was sunstruck; and between the 20th of the

same month and the 15th of August, he suffered from three strokes of paralysis, resulting finally in total blindness. His sight gradually returned, but by degrees his shoulders became lame and stiff, so that he could with difficulty use them. This state of things continued until about the middle of September, when both knees and ankles commenced to enlarge. In November, when the patient applied to us for treatment, we found him suffering from severe sub-acute synovitis. Both knees were enormously swollen, the fluid having accumulated to such an extent that the patellæ projected forward more than an inch. Four applications were given, one every day, but with no marked effect, except that the lameness of the shoulders and ankles was much relieved.

He then left the city and was absent one week. On his return the improvement was found to be very great. The accumulation of fluid in the knees had almost entirely disappeared, and the swelling was reduced in proportion. At first, the very strongest current from Kidder's apparatus made no impression, when applied down the spine. The legs were but little sensitive to the electric stream, and the feet and toes, which are generally very readily affected, were remarkably torpid. The applications were continued on Dec. 3d, 4th, 5th, 7th, and 9th, effectually removing this want of sensation, and completely dissipating the remaining swelling and tenderness of the knees.

PARALYSIS.

Case First.—Mrs. S. was first seen February 6, in consultation with Dr. Moreau Morris. Her history was, that about three years before she had given birth to a child, since which time she had been an invalid. She could walk only with difficulty, and by the aid of some support. A few weeks before we saw her, she had suffered an attack of what appeared to have been a rush of blood to the nervous centres, followed by increased weakness. She was of slender form, and was somewhat emaciated. She complained of persistent coldness in the feet, that at times was almost painful. Her appetite was capricious, her bowels very much constipated, and she was also annoyed with neuralgic pains in the left side. On examination, we found the muscles of both legs were inactive and shrunken, and were very slow to respond to electrical excitation. The flexors of the left leg had entirely lost their muscular contractility, and the whole limb presented an unhealthy aspect. The case appeared to be one of functional paralysis, associated with general debility. Whether this anæmic state was the result of some central lesion, it was manifestly difficult to determine. The indications for treatment in this case were,

1st. To improve the general condition by some effective tonic.

2d. To restore the muscular contractility and increase the blood circulation in the lower limbs.

As internal medication had been tried in vain, it was resolved to see what could be done by electricity alone, using general and local applications. During the first week of treatment the patient complained of some restlessness at night, but of no other unpleasant symptom. From that time there was a gradual progress. Her appetite has increased, her bowels have become more regular, and her rest at night is less disturbed. The pains in the side left her the third week of the treatment, and have returned but slightly on one or two occasions. Her muscular system throughout is somewhat firmer and harder, and consequently she has very perceptibly improved in her general appearance. The circulation in her lower limbs has so far improved that she complains less of cold feet, and the color both of the right and left leg is more natural. She can walk about with greater ease and for a longer time than before, but more on account of the fact that her general vigor is greater, than from any special increase in the contractility of the affected limbs. We shall hereafter resort to the use of the continuous stream on the muscles of the lower extremities, still continuing our general tonic applications with the faradaic current. Anything like an absolute restoration in such cases is of course not to be expected.

Dr. Todd, of London, has advanced the idea first suggested by Marshall Hall, that by means of electric currents we can diagnosticate some of the different types of paralysis. His theory is that when the electro-mus-

cular excitability of the affected part is lost, or nearly so, or is normal, we have a case of curable paralysis, caused either by lead poison, rheumatism, hysteria, or exposure to cold, or by some other peripheral irritation; and when the electro-muscular excitability of the affected part is increased above the healthy standard, we have a case of incurable paralysis, connected with some persistent irritating brain lesion. These theories will, we believe, stand the test of experience.

Case Second.—W. G. was sent to us by Dr. Chalmers to be treated for anæsthesia, and partial loss of the power of motion of the thumb and fingers of the left hand. He stated that ten months previous he had suffered from swelling and pain in the left hand; that the "skin burst," and that he afterwards lost all sensation in the thumb and fingers. He was unable to grasp anything firmly.

He complained of a feeling of coldness in the affected parts, that, at times, was quite annoying. The skin was dry and shrivelled. His general health was so good that we employed only local applications, and those were as strong as he could possibly bear. Both the descending and ascending secondary currents were used, and the electrodes were applied along the course of the median nerve and its branches. The progress was slow but steady. The sensation gradually returned, and after fifteen applications was completely restored in all the parts except the tip of the second finger. He then returned to his occupation, which was that of a house-

carpenter, and found that he could labor nearly as efficiently as ever. The feeling of coldness still continued to annoy him occasionally, more particularly in stormy weather. He has since informed us that sensation has also returned in the tip of the second finger.

Case Third.—Mr. C., a gentleman 60 years of age, represented that in October, 1864, he began to be affected with severe pains in his legs and feet, which were most severe at night, with alternations of heat and cold. The power of flexion and extension of the muscles of the leg gradually left him, until he could walk only with difficulty. The pain also left him, and a feeling of numbness, like that of a "foot asleep," remained, that was soon followed by entire loss of sensation. When he first came to us, Jan. 15, 1867, he could hardly raise his feet, saying that they felt "like dead weights." The loss of sensation and motion was more marked in the left foot than in the right. He was a large, well formed man, and, notwithstanding his age, appeared to be in quite vigorous health. On making the first application it was found that the muscular contractility was somewhat diminished, especially in the left leg; and the sensation was so blunted that he did not feel the entire force of the machine, even when the electrode was placed on the extremity of the toes. After four vigorous applications of the ascending and descending faradaic current (the positive pole being pressed against the ball of one foot, while the negative was applied to the

other), the sensation in a good measure returned, and he found that he could flex and extend his toes with less difficulty. The same treatment, continued for a month, gave very favorable results. His gait was much more natural, and the sensation to a considerable extent returned in both feet.

Case Fourth.—Mr. S., a young man of about 30, was sent to us by Dr. Austin Flint, to be treated for paralysis of sensation of both legs, from which he had been suffering for nearly a year, caused by syphilis, as there was some reason for believing. Four or five applications were made without any observable results. The patient then left us scarcely any improved. Reasoning from analogy, it would seem that he might have been somewhat benefited by a long course of treatment.

INFANTILE PARALYSIS.

Case Fifth.—Nathan H., aged 3 years. During the month of July, 1866, the little patient was first brought for treatment. Both limbs were atrophied, the left more considerably than the right. The child was scarcely able to support his own weight. About a dozen applications were given, and with marked improvement, so far as warmth and strength of limbs were concerned. During the month of August the treatment was discontinued; but on the first of September, when

the boy was again brought to continue the applications, he was able to walk alone and with comparative ease.

Case Sixth.—Benj. A., aged 3 years. His mother stated that eighteen months before (April, 1865), after suffering severely in teething, the paralysis first showed itself. For several months the child had been taken to public clinics, where cod-liver oil had been given, but with no decided improvement.

He was first brought for treatment about the 5th of September, 1866, and up to October 22, received fifteen applications of the faradaic current. When first seen, the legs were much atrophied. The circulation was deficient, and the limbs were powerless to bear the weight of the body. The improvement manifested, although very gradual, was encouraging; and it is to be regretted that the parents, who lived a considerable distance from the city, ceased to visit us. At the end of treatment, the little patient could easily stand, by the aid of a chair. The limbs had increased somewhat in size, and the warmth of both was much greater than six weeks before.

CHRONIC INFLAMMATIONS OF MUCOUS MEMBRANES.

Having always been taught that electricity was not good for inflammations, we were only convinced of the error of the theory by repeated observations of its beneficial effects on persons affected with catarrh, bronchitis, and ulceration of the membrana tympani.

We find that electricity is a powerful adjuvant in the treatment of all chronic inflammations of the pharynx, larynx, and nasal passages, both for its general tonic influence, and for its local corrective power. It allays the irritation caused by the application of nitrate of silver, and those upon whom we have employed it for this purpose, desire to have it repeated. Electricity has been long used in diseases of the ear with various success. It is now known to all aurists that deafness, in the majority of cases, is a symptom of some form of inflammation of the auditory apparatus. It is therefore logical to infer that electricity would be of value in the treatment of such maladies, and so we have found it in a number of cases.

Case First.—Elisha L., aged 17. When five years of age he was attacked with scarlatina. A few weeks after recovery he was pulled violently by both ears, since which time he had been very deaf, and could with difficulty be made to hear when spoken to in a boisterous tone of voice. We first saw him Jan. 24, 1867, when he could hear the tick of a watch only when it was pressed firmly against the ear. The membranæ tympani were somewhat thickened, and there were evidences of inflammation in the right external auditory canal. For the sake of experiment, we concluded to test the effects of electricity, directing the patient to place his hands on the piece of copper to which the negative pole was attached, and applying

the positive below and anterior to the auricle. At the close of the operation he could hear the watch four inches on each side. On the next visit we found that he retained all that he had gained, and could hear conversation much easier than at first. We then inflated the tympanic cavities by Politzer's apparatus, with the result of increasing the hearing-distance two inches on each side. We had intentionally delayed this very important operation in order to see first what might be accomplished by electrization alone. The tubes were readily permeable. The patient shortly after left the city, and we have had no information in regard to his subsequent progress.

In cases of ulceration of the membrana tympani and chronic inflammation of the middle ear, accompanied by offensive discharge, and associated with deficient vital force, we have found that general tonic applications wonderfully assist the local treatment of syringing and astringents. Of those patients whom we treat for pharyngitis and ulceration of the membrana tympani, those upon whom we employ electricity as an adjuvant seem to progress more rapidly and more satisfactorily than those upon whom we do not; and so marked is the difference in the results that we now rarely treat such cases for any length of time without resorting either to general or local applications.

Case Second.—G. B., of Conn., a lad of 14, when two years old had suffered from the measles, that had left

him with ulceration of the membrana tympani, and inflammation of the middle ear on the left side, attended with profuse and offensive discharge. A few months before he called upon us the right ear had also commenced to discharge, and some alarming symptoms of vertigo began to manifest themselves. The pharynx was affected with follicular inflammation, as usually obtains in such cases, and an annoying, persistent cough made his friends apprehensive of tuberculosis. His appetite was capricious, his muscles flabby, and his general condition below par.

Examination by the mirror and speculum revealed the absence of the left drum, and a small perforation on the inferior portion of the right. The hearing distance of the left ear was three inches; of the right, two feet. The eustachian tubes were pervious.

Dr. D. B. St. John Roosa afterwards saw the case in consultation, and confirmed the somewhat unfavorable prognosis that we felt compelled to give. It should be stated, moreover, that the lad had been treated for his difficulty by various physicians. At one time he submitted to constant blistering over the mastoid process, for several months. We decided to employ both general and local treatment. The ears were ordered to be syringed with lukewarm water every night, after which a solution of sulphate of zinc (grs. iv. to ʒ j.) was to be dropped in and retained for a few minutes, while the patient inflated the tympanic cavities by closing the mouth and nostrils and blowing vigorously. He visited

us every week regularly, at which times we usually treated his pharynx by applications of a solution of nitrate of silver, of moderate strength, or by a solution of permanganate of potash, and inflated and cleansed the tympanic cavities by Politzer's apparatus. There was immediate temporary improvement of the hearing; but for the first month there was no perceptible diminution of the discharge. We then began to make use of general applications of the descending faradaic current over the whole body, and particularly below and anterior to each auricle, pressing the fingers firmly against the skin. It was not long before good effects were manifest, so far as his general health was concerned, although the condition of his ears improved but slightly. Whereas, at first, he was much fatigued by the mere exertion of coming to the city and visiting the office, he could now join with alacrity in the vigorous sports of his companions. By the 1st of February, 1867, the attacks of vertigo became very unfrequent, the appetite had increased in sharpness, the sleep was sound and undisturbed, the pharyngeal inflammation and the vexatious cough had entirely disappeared, and he had gained several pounds in flesh. We now added the internal administration of iron to the other remedies; but continued on with the use of the ear-drops, and the general applications of electricity. By the 1st of March the discharge from the right ear had entirely ceased, and in the left had greatly subsided. Calcined magnesia, blown in a few times against the

inflamed surface, at this time seemed to operate favorably, and the patient was directed to come occasionally for general applications, mostly discontinuing the local treatment. The hearing distance had increased on the right side one foot, and on the left two feet. In this case the agents employed to combat the local inflammation and general debility were so numerous and so varied, that it is impossible to determine with accuracy just how far the amelioration was due to the application of electricity. But as little or no progress was made while mere local treatment was employed, and inasmuch as after we began the tonic applications all unpleasant accompanying symptoms—the hacking cough, the irritation in the throat, vertigo, and general weakness—disappeared, we naturally infer that the electricity was a very important if not indispensable adjuvant to the other remedies.

Case Third.—Mr. L., a clergyman from Brooklyn, came to us Dec. 15, 1866, complaining of a throat difficulty of fifteen years' standing that at times had made it very difficult for him to fulfil his duties in the pulpit. Occasionally he had been compelled to rest entirely, for a considerable interval, from all public speaking. He complained of a feeling of heat and dryness in the throat, and of continued hoarseness, that increased at times so that he could only speak in a whisper, and also of a very annoying and persistent cough. His pharynx was so exceedingly irritable that we found it very

difficult at first to make a satisfactory laryngoscopic examination; but this sensitiveness was in a measure overcome by perseverance, and we were enabled to gain a view of the vocal cords, and inspect the upper portion of the trachea. We found the entire mucous membrane of the pharynx and larynx affected with follicular inflammation. The secretion was abundant, especially in the vicinity of the vocal cords. Physical examination of the lungs convinced us that his cough was mainly the result of chronic bronchitis, and, as his general health was excellent, we decided to employ local applications of nitrate of silver, and to make use of inhalations, giving no constitutional treatment whatever. He visited us two or three times a week, and soon began to improve slightly; but as we were not satisfied with the progress he made, we employed local applications of electricity. The results were unexpected. Not only were the irritating effects of the applications of nitrate of silver temporarily relieved, but permanently beneficial results seemed to follow at once, both for the throat affection, and more especially for the cough, which all along had been one of his most distressing symptoms. When he discontinued the treatment the cough had almost entirely disappeared, and the inflammation of the larynx was in a good degree subdued. His vocal cords also were stronger; but we advised him to rest for a while from his public labors, in order to avoid the danger of any relapse. But his voice gained so rapidly in strength and clearness, and his

general condition so decidedly improved, that he shortly after resumed the full exercise of his pulpit duties.

PROLAPSUS UTERI.

Dr. Seiler, of Paris, published a work in 1860, entitled "*Galvanization par Influence*," in which he reported a number of cases of uterine displacement that had been relieved or cured by electricity.

In prolapsus uteri general electrization is very often of great service, chiefly by its tonic effects on the system at large, and on the walls of the vagina. All gynecologists will agree that prolapsus uteri is usually associated with relaxation of the vaginal walls, and also with general debility, and that whatever will give tone to the system and to the weakened parts must be of service.

Miss T——, an unmarried lady, aged 30, applied for treatment for falling of the womb of the second degree, from which she had suffered for nearly six months. Previous to the first symptoms of prolapsus, persistent leucorrhœa had annoyed her for some time, and had continued up to the day she came to us. She complained also of some menorrhagia, and this, together with the constant leucorrhœa, had deprived the vagina of its tone. These conditions, however, were evidently associated with no organic uterine disease; but her general health was quite feeble. If it were a case for electricity at all, it was plain that she needed its tonic influence. We commenced, therefore, with mild, general applications, increasing the strength of the current

at each visit, as she was able to bear. At each sitting, also, the electrode was pressed for a few minutes against the os and the walls of the vagina. The beneficial results of this course of treatment were soon observable. Her appetite, which had been capricious, became more rational, and her strength increased with marked rapidity. The vaginal walls seemed to gain tone day by day, until after the sixth application the uterus was restored to its normal position.

OTHER INDICATIONS FOR THE USE OF ELECTRICITY.

We shall merely allude to the other indications for the use of electricity, for if the general principle in regard to its tonic and corrective effects be true, then it is evident that it may be fairly tested as an adjuvant wherever such effects are desired. It has been used in surgery in the form of *galvano-cautery*, for discussing *tumors*, for stimulating *ulcers*, for hydrocele and chronic urethritis. It has also been used in *intermittent fever*, and with good results. In *incontinence of urine* associated with general feebleness, it often works very effectively.

Much has been said of its powers as a *galactogogue*, and some interesting results as well as failures have been reported. In *progressive locomotor ataxia*, or Duchenne's disease, this agent has not achieved very great results. In *epilepsy* we have sometimes found it to be positively and speedily beneficial, and sometimes it appears to be entirely inoperative.

But, notwithstanding the fact that electricity, employed in the manner we have described, is indicated in a wide range of diseases, it is as yet very far from being a panacea, even in the most skilful and practised hands. For some diseases it is found to be in no way adapted by our method of application, although a wider experience may teach us *that the fault lies in the method of administration and not in the remedy.* In the treatment of shaking palsy, we have uniformly failed to give the slightest relief; and in cases of paralysis, dependent on *persistent* lesions of the nervous centres, we do not expect to be of much service. But so difficult is it, even for the ablest diagnostician, to discriminate between the different forms of paralysis, that we usually make at least a few trials on most of the cases that are brought to us, in order to ascertain, if possible, by the electric test, whether there be any chance of relief. We are oftentimes agreeably disappointed by a favorable issue in cases that at first seemed to promise but little.

NOT SUCCESSFUL IN PULMONARY TUBERCULOSIS.

We have already stated that faradaization, as we employ it, does not seem to be adapted for cases of pulmonary tuberculosis the first stage. Dr. Bastings, of Brussels, has recently published a work, in which he claims to have cured twenty-five cases of phthisis by means of the galvanic stream, applied around,

not through, the chest, for the purpose of increasing the muscular development. The theory of his treatment, as we understand it, is substantially the same as that advocated by Dr. Davis, in his recent work on "Conservative Surgery." The book is prepared with apparent fairness, and we shall endeavor, as occasion offers, to subject his theories to a practical test.

NECESSITY OF CAUTION IN THE USE OF GENERAL ELECTRIZATION.

But there are certain temperaments and certain stages of disease that will allow only of very mild applications of electricity, where indeed unpleasant effects seem to follow, temporarily at least, unless the treatment be commenced with great caution.

Mr. F., sent to us by Dr. Fordyce Barker, complained of a kind of neuralgia of the neck of the bladder. He was a stout, well formed man, and in all other respects was in perfect health. The first applications were made with the p sitive pole on the lower part of the spine, over the lower part of the abdomen, and against the perineum, mildly at first, but afterwards with greater power. For a number of days after the fourth visit the patient complained of soreness of the muscles (a not unusual temporary effect at the commencement of treatment), and of general prostration, which annoyed him for several days. Such cases, in healthy individuals, however, are purely exceptional.

For the majority of patients even an overdose is only followed by a feeling of soreness that soon passes away.

Those who receive an application of too great power will not usually experience the prostrating effects before the following day; but even to this rule there are exceptions. In very aged persons, or those enfeebled by disease, we always begin with mild applications, and gradually increase the strength according to the indications, allowing intervals of several days between the visits. It should be remarked, however, that we have obtained some of our most successful results in cases that at first seemed to be injured rather than benefited. Occasionally, in those affected with digestive derangements, the first operation causes prostration and vomiting, that seems to clear out the system, and prepare the way for recovery.

PRACTICAL SUGGESTIONS.

We close with a few brief suggestions for the benefit of any who may be induced to study this subject for themselves.

1st. Get the best apparatus and become thoroughly familiarized with the details of its management. Much of the discouragement that has thus far attended experiments in this department has been due to the fact that it has been impossible to obtain any convenient, easily adjusted apparatus. The old-fashioned magneto-electric machines, where the electricity is generated by

turning a crank, are to the last degree inconvenient, and it is not to be wondered at that those physicians who use them soon become disgusted with the whole subject. The electro-magnetic apparatus that we employ, and which we decidedly recommend, is manufactured by Jerome Kidder, of this city. It has a powerful helix, a very readily managed armature, and is run by the ordinary Smee's battery or by Farmer's thermo-electric apparatus. A moderate amount of experience will enable one to manage it successfully, and to keep it always in order.

2d. Make the applications *general*. *Localized electrization*, according to the method of Duchenne and his followers, is serviceable in paralysis, acute neuralgia, and kindred affections; but where a general tonic effect is desired, as in dyspepsia, rheumatism, amenorrhœa, chorea, constipation, anæmia, and in other diseases associated with deficient vital energy, *general electrization* is indispensable.

The modus operandi of general electrization is as follows:—Male patients remove their stockings and all their outer and under-clothing from the upper part of the body, and place their feet on the piece of copper to which the negative pole is attached, while the operator applies the positive, either a wet sponge or the moistened hand (when the current passes through his own person), down the spine and over the vital organs. Ladies remove their dress and loosen their under-garments, and throw over their shoulders a shawl, or sheet, to pre-

vent exposure. The most thorough form of application demands that the entire surface of the body should be gone over with some regard to order.

Special pains should be taken to avoid the scapula, clavicle, sternum, crest of the ilium and tibia (or when they are touched, to carefully graduate the current), inasmuch as these and other bony prominences are very sensitive to the electric current.

3d. Be prepared for the occasional occurrence of unpleasant or equivocal symptoms at the outset of a course of treatment. The soreness of the muscles, headache, and general depression, that are sometimes experienced a day or two following the first application, will soon pass away, provided the subsequent treatment be judicious.

Applications to the head should *always* be made with the hand, and should be very mild. Cases that begin unfavorably often result in the most complete cures.

For patients who are much reduced it is best to allow intervals of several days between each application, especially at the beginning of the treatment. In the majority of cases sittings may be held every other day, or when merely localized electrization is employed, every day.

4th. Let the first tentative applications be mild and of short duration, say from five to ten minutes, and increased in strength gradually as the patient is able to bear. Afterwards, the strength of the current, whether employed with the hand or sponge, should be as great as can well be borne. Let the patient be *comfortably uncomfortable.*

5th. For nearly all chronic affections the treatment should be persistent. While great and beneficial effects are often derived from two or three applications, a complete or approximate cure can only be achieved by continuance of the treatment, varying the strength of the current and frequency of the applications according to the progress which is made. Cases of paralysis of long standing demand a protracted course of treatment even where there is no very serious lesion of the nerve centres. In many cases of paralysis, and in some phases of rheumatism, the improvement may be hastened by the use of the continuous galvanic stream. And yet even in paralytic affections general electrization seems to achieve very much that has been claimed for localized electrization with the constant stream.

6th. Although general electrization is indicated in a large variety of diseases, it is very far from being a panacea. It is a *tonic*, and it is to be employed on the same principles, and subject to many of the same limitations as are all other tonics, except that it is more rapidly and surely effective than any internal medication. If the system be below par, as a result of any chronic disease, or combination of diseases, then general electrization is indicated in conjunction with or prior to the use of iron, quinine, bathing, air, exercise, society, and all other tonic influences whatsoever.

But it should ever be remembered that it is *general electrization*, employed in the manner we have described, and not "electricity" or "localized electrization," that

produces constitutional tonic effects, and thus cures disease.

The result of the treatment will depend as much on the skill and perseverance of the operator as upon the powers of the agent he employs. Success in this, as in all other departments of science, is reserved for those who, unswerved by prejudice and unbiased by theory, seek only for the knowledge that comes from careful, patient, and repeated experience.